Faculty of Information and Communication Technology

THE DESIGN AND EFFECTIVENESS OF 3D COURSEWARE WITH CONSTRUCTIVISM AND CONTEXTUAL APPROACH

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THE DESIGN AND EFFECTIVENESS OF 3D COURSEWARE WITH CONSTRUCTIVISM AND CONTEXTUAL APPROACH

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DECLARATION

I declare that this thesis entitle "The Design and Effectiveness of 3D Courseware with Constructivism and Contextual Approach" is the result my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality as a partial fulfilment of Master of Science in Information and Communication Technology.

Signature : ……..

Supervisor Name : DR. HJH. NORASIKEN BAKAR

Date : ……..

DEDICATION

To my beloved father and mother,
Hj. Mohd Zain bin Abdullah and Hjh. Wan Munah bt. Wan Mohd Ghazali
Brothers and sisters

For my supervisors,
Dr. Hjh. Norasiken Bakar and co-supervisor Miss Syariffanor Hisham
(UTeM)

Lastly to my beloved friends who are encouraged, guided and inspired me. Without their patience, understanding, support and most of love, the completion of this work would not have been possible. Special thanks to Solas Mohd Zainal Abidin who give me courage and inspiration also to all who contributed to complete this thesis.

ABSTRACT

The usage of multimedia courseware can be used as one of the methods to increase the motivation and interest of student towards the subject that being taught. This research is about the design and effectiveness of 3D courseware with constructivism and contextual approach. This courseware is specifically developed for a topic in chemistry subject for form five students in Malaysia. The topic chosen are Alkenes and Isomerism which is a part of hydrocarbon topic in chemistry secondary syllabus. The research was done at Melaka involving Form five Students who took *Sijil Pelajaran Malaysia* (SPM) in year 2010.The questionnaires is the instrument used in this research to determine the problem statement. Based on the questionnaires, Alkenes and Isomerism are identify as the most difficult topic and suggested a courseware is developed and then tested for its effectiveness. The courseware used MAYA software version 2010 to develop the 3D molecules of Alkenes structure. Two group of students called Experimental group (EC) and Control group (CG) involved in this process and a set of questionnaires is used during pre-test and post-test for this purpose. A pilot study is running to determine the effectiveness of the courseware before testing is carried out that learning using this courseware is more effective, accepted to be used in teaching and learning process. From this research the researcher finds out that learning using courseware is more improve the learning achievements during teaching and learning process as teaching aid as it implement constructivism and contextual approach in learning process. Learning using courseware with these approaches also help to increase student's performance for the topic.

ABSTRAK

Penggunaan perisian multimedia dalam bidang pendidikan merupakan satu kaedah yang boleh digunakan untuk meningkatkan motivasi dan minat pelajar terhadap subjek yang diajar. Kajian ini adalah mengenai rekabentuk dan keberkesanan perisian 3D dengan menggunakan pendekatan kontruktivisme dan kontekstual. Perisian multimedia ini dibina khusus untuk satu tajuk dalam matapelajaran kimia bagi pelajar-pelajar tingkatan lima di Malaysia. Topik yang dipilih adalah Alkene dan Isomerism yang merupakan satu bahagian daripada tajuk hidrokarbon dalam sukatan matapelajaran Kimia.Kajian ini telah dijalankan di Melaka dan melibatkan pelajar-pelajar tingkatan lima yang mengambil Sijil Pelajaran Malaysia (SPM) bagi tahun 2010.Borang soal selidik adalah instrument yang digunakan dalam kajian ini untuk mengenalpasti pernyataan masalah.Berdasarkan soal selidik tersebut, Alkenes dan Isomerism dikenalpasti sebagai tajuk yang sukar difahami dan dicadangkan satu perisian multimedia dibangunkan dan diuji keberkesanannya. Perisian multimedia tersebut menggunakan perisian MAYA versi 2010 untuk membina struktur molekul-molekul Alkenes dalam persekitaran 3D. Dua kumpulan pelajar yang dikenali sebagai Kumpulan Eksperimen (EG) dan kumpulan kawalan (CG) terlibat dalam proses ini dan satu set soal selidik digunakan dalam proses pra ujian dan post ujian. Satu ujian "pilot study" dijalankan untuk menentukan kebolehpercayaan perisian multimedia sebelum pengujian dijalankan. Daripada kajian ini,pengkaji mendapati bahawa proses pengajaran dan pembelajaran tajuk ini menggunakan perisian multimedia adalah sesuai sebagai alat bantu mengajar di samping ia menyelitkan pendekatan kontruktivisme dan kontekstual. Pembelajaran menggunakan perisian dengan pendekatan pembelajaran ini juga membantu meningkatkan pencapaian pelajar bagi topik tersebut.

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LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation & Evaluation
MOE	Ministry of Education
SPM	Sijil Pelajaran Malaysia
MRSM	Maktab Rendah Sains MARA
ICT	Information & Communication Technology
SPSS	Statistical Package for Social Science
3D	3- Dimensional

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Teaching and learning is an important process that happens in a classroom. Many studies have been carried out to identify the learning strategies and learning technique that is suitable to be implemented in classroom. This is to ensure that teaching and learning process reach its goal which is student get the knowledge and student is inspired to find the knowledge even they are not in the classroom.

Teaching and learning become more adventurous in 21st century. The progressing in ICT field expresses the big impact towards education process. Many researches show that ICT give positive effect to the teaching and learning process whether for the student or the process itself. ICT help to fasten the government agenda in education long term plan.

1.1 Research Background

The idea of Vision 2020 was announced by former Prime Minister of Malaysia, Dato' Seri Mahathir Mohamad during Malaysian Business Council Conference on 28 February 1991. The purpose of Vision 2020 is to develop Malaysia into an industrialized country with our own mould. There are nine challenges in Vision 2020 for Malaysia in the process to achieve an industrialized and a fully developed nation by the year 2020.

The science education become more important in Vision 2020 through it sixth challenges (Rose Amnah et al, 2004). The sixth challenge of Vision 2020 is the challenge of establishing a scientific and progressive society, a society that is innovative and forward-looking, and one that is not only a consumer of technology but also a contributor to the scientific and technological civilization of the future.

In 1996 Malaysia established The Multimedia Super Corridor (MSC Malaysia) to accelerate Malaysia's entry into the Information Age, and through it, help actualize Vision

2020. The MSC project consist of 7 flagships and one of the flagship is smart school concept. The smart school initiative is regarded by the Prime Minister as a specific response to Malaysia's need to make the critical transition from an industrial economy to a knowledge-based society (Mahathir Mohammad, 1998). The philosophy of Malaysia Smart School is all students can learn if taught. The curriculum designed considering the difference capabilities and needs of all students. Other characteristics of the schools are conducive school climate for learning, on-going assessment, strong and professional teachers and principals also high level of parent and community support and involvement. The Ministry of Education created a group of 84 Smart Schools in 1999 as pilot school, which is a sampling of arrange of schools nationally (Smart School Project Team, 1997).

The Smart School outlined nine visions for the curriculum. One of the visions is to use technology as one delivery system, examines the influence of technology on student lives and gives students the skills they need to use technology (Smart School Project Team, 1997). The curriculum is focus to all-round development student appropriate for information age by helping students achieve overall and balanced development also integrating knowledge, skills, values and correct use of language across curriculum. Scientific skill and information technology skill are parts of the skill that is hoped to have by the students. IT literacy skill means students are able to use IT tools and IT source to collect, analyse, process and present information thus support meaning learning in a variety of contexts. At the end the skill, prepare the students for working life (Smart School Project Team, 1997).This is in lined with the age of 21st century. Shifting education must be parallel with 21st century as it is important to prepare student to face real world outside classroom (Norrizan, 2011).

Smart School uses IT as main part of its concept. IT uses in conducting school management, networking system inter and intra schools in school assessment program. A lots of IT facilities are equip in the smart school. There will be classroom with multimedia courseware and presentation facilities to convince the teaching and learning done effectively. A media center for multimedia courseware and network resources like access to the internet is provided. The IT plan also cover a computer laboratory for teaching and as multimedia development center. Other facilities included are a studio with control room for centralized

audiovisual equipment, teacher's room with access to internet, school management with database to get information electronically and server room (Smart School Project Team, 1997).

Another aspect that marked the importance of IT in smart school concept is the preparation of material for teaching and learning process. The Ministry of Education introduced the use of multimedia courseware for four subjects that are *Bahasa Melayu*, *Bahasa English*, Science and Mathematics. ICT uses to accelerate learning process and at the same time fulfill the needs and capabilities of the students.

Based on Datuk Seri Najib bin Tun Haji Abdul Razak, Smart school is:

> *"An exciting development of our education system is the creation of Smart Schools. Smart schools are being planned in stages nationally, not only to meet the requirements of the Multimedia Super Corridor, but also to create a new generation of Malaysians–Malaysians who are more creative and innovative in their thinking, adopt with new technologies, and able to access and manage completely the information explosion.*"
>
> (Blueprint Smart School Pioneer Project, 1998)

Teacher's role is vital in implementing ICT literature to students. Teacher becomes facilitator or instructor that not only preparing the suitable environment for learning process but also help and instil good value in students for their future. Teacher play important role to guide students to surf internet, finds website, chose the right courseware also collect and review information (Norrizan, 2011). Based on Mateer (2011), instructor can engage students and produce more meaningful and deep learning experiences by using films, television shows, popular music, new stories, literature, documentaries and videos from sources such as YouTube.

When ideas about *Sekolah Bestari* projected to the Malaysian public, people started imagining classrooms packed with computers; internet, video conferencing equipment's and all the latest communication technology can offer (Rohaida, 2005). The most important in Smart school concept is teaching-learning processes. The teaching-learning processes are the core or the "heart" of the Smart School. The processes relating to curriculum, pedagogy,

assessment, and teaching-learning materials is reinvented to help students learn more effectively and efficiently. The Smart School will enable students to practise self-accessed and self-directed learning, at their own learning pace (Ministry of Education, 2006). Because of the globalization age revolves around ICT, educational development should therefore place importance on the socialisation and mastery of ICT skills among students (Fazli, 2011).

The smart school is developing with the special characteristic. It also designed to establish a few scenarios in today's school environment (Smart School Project Team, 1997). The smart schools implement improvements in the education and training delivery system with high quality and relevant to current needs (Norrizan, 2011). At the same time, it will strengthen the national school as the school of choice for the diverse ethnic groups of Malaysia, and this will promote national unity (Rohaida, 2005). The smart schools also help to narrow the performance gap between schools in the rural and urban areas Mateer (2011). When upgrading the quality of teaching, infrastructure, facilities as well as posting experienced teachers to rural schools, the difference between rural and urban school become smaller. The concept of smart school also brings the education into higher level (Ministry of Education, 2006). The idea will be prolonging to establish excellent universities and ensure education and training at the tertiary level fulfills market needs. Hence, it will create more opportunities and access to quality educational training and life-long learning at all levels. At the end, the smart school helps to develop an innovative and creative society, which is rooted in knowledge with strong grounding in science and technology as well as having the ability to acquire and apply knowledge in general (Ministry of Education, 2006).

Teaching and learning based on computer had grown since forty years ago and the latest innovation is multimedia field (Halimah, 1999). Multimedia technology has expended the usage of computer from information processing tools to teaching tools. According to Halimah (1999), multimedia technology has ability in delivering text, video, sound, animation and high resolution graphic. An information delivery effect created by combination of images, texts, and sounds has shown the significance everlasting compared to listened or read (Schmalz, 2008). Combination of these elements will create an interesting presentation and make the information conveying more meaningful. The use of media to enhance teaching and

learning complements traditional approaches to learning process (Mateer et al., 2011). Teaching using multimedia technology is able to get the student's attention, get the idea, and gain the complex information and help to prevent lack of time, size and space. Computer-based teaching media that has interactive or linear movement can able the user to access the information from one segment to another without following the flow.

The Malaysian Government generally and the Ministry of Education specifically has undertaken various initiatives to facilitate greater integration of ICT to enhance the effectiveness of education and training programmes (Balakrishnan, 2010). The Ministry of Education sees ICT as a tool to revolutionise learning, to produce richer curricula, to enhance pedagogies, to lead to more effective organizational structures in schools, to produce stronger links between schools and society and to empower learners (Belawati, 2007; Balakrishnan & Rossafri, 2010). There has been interest expressed in science education reform which emphasise the need for integrating computer technologies into learning and teaching (Norshahidatul, 2013). Computer also used effectively as a general pedagogical aid that complements regular teaching methods. ICT can serve as a tool for designing new learning environments, integrating virtual models and creating learning communities. Learning courseware offers an effective tool for education since it involves all the senses, giving a modifiable three dimensional (3D) environment emulating and overcoming reality (Norshahidatul, 2013). The establishment of Smart school across Malaysia has activated a demand for more locally produced educational multimedia courseware (Baharuddin, 2006)

The term teaching refers to the methodology or strategies chosen in arranging the information, activities, approaches or media in order to help the students achieve the objective stated earlier (Zaleha, 2008). Learning is the change in behaviour in the students that occurs because of their interaction with the surrounding (Baharudddin, 2006). ICT use to enhance the learning environment making the learning more practical, improving the learner's access to learning, increasing the focus of higher order skills. Other than that is to make possible to adapt learning programme more nearly to the needs of individual. One way of teaching for understanding is to have students engage in information processing and problem solving activities that focus on real-world experience. The term, Education technology is used to

referred to a process of using our knowledge which includes the body of knowledge in the entire field of education and any pertinent scientific and technical knowledge in all other discipline, for designing the most appropriate learning environment for student success (*Portal Pendidikan Utusan Malaysia*, 2011).

Based on Mateer et al. (2011), media can be used to engage students, aid student retention of knowledge, motivates interest in the subject matter and illustrates the relevance of many concepts. In Educational technology, teacher's role not focusing on the usage of readymade courseware only but also covering the aspects of instructional design of learning process(*Portal Utusan Malaysia*, 2011).

1.2 Problem Statement

The problem about learning chemistry is the subject is always said to be tough. The difficulty of understanding the concept of chemistry can lead to the low performance in the study. Chemistry has been regarded as a difficult subject for young students by chemistry teachers, researchers, and educators (Kirkwood & Symington, 1996; Lorenzo, 2005; Nakhleh, 1992). Students view chemistry as one of the most difficult subjects to study at all levels of schooling (Ozmen, 2005). Chemistry is a subject that dealing with explaining about physical process at the atoms and molecules level. In order to explaining the physical process, student should understand the nature of atoms, the arrangement and its properties in various different situations. When student fail to understand the arrangement of atoms in a process they find it difficult to explain about the physical process. This is as said by Rhonda 2011 that many students reported to have trouble with the conceptual nature of chemistry.

Based on Sennese (2010), chemistry is the study of the composition and properties of matter, the reactivity of substances and connections between the everyday world and the molecular world. In order to understand chemistry well, student must understand the nature of atoms in matter, able to explain the changes and relate it with the everyday world. According to Johnstone (1997), chemistry consists of three forms which can be thought of as corners of a triangle. No form is superior to another, but each one complements the other. These forms of the subject are: (i) the *macro* and tangible: what can be seen, touched and smelt; (ii) the *sub*

micro: atoms, molecules, ions and structures and (iii) the *representational*: symbols, formulae, equations, molarity, mathematical manipulation and graphs. Here, in order to understand the concept of chemistry, student should be able to relate the atoms and molecules with physical process and able to explain it using symbols and equations. Student should be able to think at the molecular level and explain changes at macro level in term of interaction between individual atoms and molecule. When the student fails to relate the arrangement of atom with the physical process, the subject is said to be difficult. The main problem in Chemistry is the abstraction of facts in order to understand the 3D arrangements and properties of the molecules (Alonso et. al, 2011)

Many studies all level of schooling to determine student's ideas about basic chemistry concepts suggest that students who did not acquire satisfactory understanding of scientific concepts occurred because of traditional teaching method. In traditional teacher-centred classroom the students become listeners and the teachers gives out the facts and defines important ideas. Traditional teaching method in science means students may understand the subject but only at a 'knowledge level'- memorizing the fact (Lewis, 2006).

One of the problems when student learn chemistry is students do not understand the topic well because it needs students to imagine the formation of the structure and their arrangement (Sun, 1997). By developing this courseware, it is use to stimulate student's interest in some content of the learning and as a supplement to classroom teaching, the graphics and animation make the subject come alive, so that learning the subject is much easier, animation and voice are used to implement various teaching strategies such as tutorials, activities and games. Besides that, the simple animation can be used in this courseware to make the learning of content in the class more interactive. With the development of computer technology, multimedia methods are been increasingly used in teaching practice. A multimedia courseware can combine sound and pictures with knowledge. This reinforces the fact that students retain 50% of what they see and hear, as the use of multimedia technology gives students more information than just writing on the blackboard and increase the chance of active learning (Huo, 2006).